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| APPLICATION NO.           | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---------------------------|-------------|----------------------|---------------------|------------------|
| 10/613,772                | 07/02/2003  | Arkady Kaplan        | 39878-0021          | 7151             |
| 25213                     | 7590        | 09/11/2006           | EXAMINER            |                  |
| HELLER EHRLMAN LLP        |             |                      | PEACE, RHONDA S     |                  |
| 275 MIDDLEFIELD ROAD      |             |                      | ART UNIT            | PAPER NUMBER     |
| MENLO PARK, CA 94025-3506 |             |                      | 2874                |                  |

DATE MAILED: 09/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                        |                     |
|------------------------------|------------------------|---------------------|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |
|                              | 10/613,772             | KAPLAN ET AL.       |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |
|                              | Rhonda S. Peace        | 2874                |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on \_\_\_\_\_.
- 2a) This action is FINAL.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-69 is/are pending in the application.
  - 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1-37,40-60,62,63,68 and 69 is/are rejected.
- 7) Claim(s) 38,39,61 and 64-67 is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 02 July 2003 is/are: a) accepted or b) objected to by the Examiner.
 

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) All    b) Some \* c) None of:
    1. Certified copies of the priority documents have been received.
    2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | Paper No(s)/Mail Date. _____.   |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>7/7/2004</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
|   | 6) <input type="checkbox"/> Other: _____.                                   |

## DETAILED ACTION

### ***Information Disclosure Statement***

The information disclosure statement (IDS) submitted on 7/7/2004 was filed in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

### ***Drawings***

The drawings are objected to because Figures 1-3 are missing component labels for various elements, and Figures 1, 4, 12, and 13 contain excessive shading and stray marks, making the drawings unsuitable for publication. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and

informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Claim Objections***

Claims 35, 27, and 38 are objected to because of the following informalities: claims 35, 37, and 38 contain improper dependency. Claim 34 recites a third input splitter and depends from claim 32; claim 35 recites a third combiner and depends from claim 32. Claim 37 recites, "wherein the third splitter and the third combiner are formed as part of a chip," and depends from claim 33. However, claims 32 and 33 do not recite a third splitter and third combiner (these elements are found in claims 34 and 35 respectively. Therefore, for examination purposes, it has been assumed claim 35 is intended to depend from claim 34, and claim 37 is intended to be dependent upon claim 35, as this dependency chain gives claim 37 proper antecedent basis. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

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2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

*Claims 1-37, 40-50, 52, 54, 58, 59, 62, 63, 68, and 69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yao (US 5654818).*

*Pertaining to claim 1, Yao teaches a Mach-Zehnder modulator 22 that produces a first output, a second Mach-Zehnder modulator 24 that produces a second output, a splitter 12 coupled to the first and second Mach-Zehnder modulators, a combiner 12' that combines the first and second outputs, and a phase shifter 52 coupled to the first and second Mach-Zehnder modulators (Fig 3, column 5 lines 63-67, hereafter indicated I the form 5:63-67, 6:1-18). Yao does not disclose the components formed on a single planar chip made of electro-optical material. However, it would have been obvious to one of ordinary skill in the art to do so, as it is well known in the art and also since conserving space would always be beneficial. Moreover, it has been held that forming in one piece an article that has formerly been formed in two pieces and put together*

involves only routine skill in the art (*Howard v. Detroit Stove Works*, 150 U.S. 164 (1893)).

*Regarding claims 2-4 and 25*, Yao disclose the device as described above. However, Yao does not state the chip to be made of a single piece of crystal selected from LiNbO<sub>3</sub> or LiTaO<sub>3</sub> cut in the X, Y, or Z planes. Nonetheless, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use those materials since it is well known to use the listed materials for the purpose of creating chips. It has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of design preference (*In re Leshin*, 125 USPQ 416).

*Concerning claims 5-10 and 16*, Yao disclose the device as described above, and additionally discloses the splitter **12** and combiner **12'** are both Y-junction and waveguide couplers (Fig 3). The splitter is also shown to be at the input of the system and the combiner at the output of the system (Fig 3). Moreover, the first and second Mach-Zehnder modulators **22** and **24** have bias electrodes coupled to them (Fig 3, 5:63-67, 6:1-18).

*Pertaining to claims 11 and 15*, Yao disclose the device as described above. However, Yao does not state the bias electrodes to be in a push-pull configuration. Nonetheless, modulators of a push-pull type are well known and one having ordinary skill in the art at the time of the invention would have found it obvious to use push-pull modulators and electrodes since they eliminate chirp and improve the quality of the optical signal.

*With regard to claim 12*, Yao disclose the device as described above, but does not specifically state the first and second electrodes are configured to optimize a DC bias point of the first and second Mach-Zehnder modulators. However, it is well known to use a DC bias voltage to control the operation of the modulator at the optimum value and one having ordinary skill in the art would have found it obvious to provide a bias voltage to the electrodes to prevent the bias point from drifting away from the optimum value.

*Concerning claims 13 and 14*, Yao disclose the device as described above, but does specifically state the splitter and combiner to be adjustable. However, one of ordinary skill in the art would have found it obvious to make the splitter and combiner adjustable, since it is well known in the art to do so for example to reduce distortion of the signal.

*Pertaining to claim 17*, Yao disclose the device as described above, but does specifically state the splitter and combiner to be 3 dB devices. However, splitters and combiners that are 3 dB devices are well known and generally conventional and one having ordinary skill in the art would have found it obvious to use such a conventional splitter or combiner.

*Regarding claim 18*, Yao disclose the device as described above, and additionally discloses the first and second Mach-Zehnder modulators **22** and **24** are driven by an RF signal 20 (5:63-67, 6:1-18, Fig 3).

*With regard to claims 19-20*, Yao disclose the device as described above, and shows in Figure 3 the first and second modulators are coplanar and are associated with at least a first and second waveguide.

*Concerning claims 21-22*, Yao disclose the device as described above, and additionally shows a second phase shifter 52' configured to provide an adjustable 90-degree phase difference between outputs of the first and second modulators (5:63-67, 6:1-18, Fig 3). However, Yao does not disclose the phase shifter to be of a push-pull configuration or to include an electrode. However, phase shifters with a bias electrode that are of a push-pull configuration are known in the art and it would have been obvious to one of ordinary skill in the art to use such a push-pull phase shifters since they provide certain advantages such as increasing linearity and range of modulation.

*Pertaining to claim 23 and 24*, Yao disclose the device as described above, and additionally discloses the splitter divides the input beam into substantially equal first and second beams that are then directed into the first and second modulators (4:37-39), and the first and second modulators are independently modulatable (5:45-49).

*With regard to claims 26-29*, the Applicant is claiming the product including the process of making the optical device, and therefore these claims are of a "product-by-process" nature. The courts have held for some time the following: the determination of the patentability of product-by-process claim is based on the product itself rather than the process by which it is made (*In re Thorp*, 777 F. 2d 695, 227 USPQ 964 (Fed. Cir. 1985); and patentability of the claim to a product does not rest merely on a difference in the method by which the product was made. Rather, it is the product itself that must be

new and unobvious. Applicant has chosen the invention in product form. Thus, a prior art product which posses the claimed product characteristics can anticipate or render obvious the claimed subject matter regardless of the manner in which it is fabricated (*In re Brown and Saffer*, 173 USPQ 685 and 688; *In re Pilkington*, 162 USPQ 147). As such, no patentable weight is given to the process steps recited in claims 26-29.

*Addressing claims 30 and 31*, Yao disclose the device as described above, but does not specifically state the chip to include a substrate coated with a buffer of silicon dioxide. However, it is well known in the art that conventional chips have a substrate coated with a buffer layer of silicon dioxide and one having ordinary skill in the art would have found it obvious to use such a conventional chip.

*Concerning claims 32 and 33*, Yao disclose the device as described above, but does not disclose the inclusion of the following elements:

- A third Mach-Zehnder modulator that produces a third output.
- A fourth Mach-Zehnder modulator that produces a fourth output.
- A second input splitter coupled to the third and fourth Mach-Zehnder modulators.
- A second phase shifter coupled to the third and fourth outputs.
- A second output combiner positioned to combine the third and fourth outputs.
- Placing the four modulators, two splitters, two phase shifters, and two splitters on a single chip made of electro-optical material.

However, it would have been obvious to one of ordinary skill in the art to include a third and fourth Mach-Zehnder modulator, as well as a second input splitter, second combiner, and second phase shifter, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art (*St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8). In addition, placing the four modulators, two splitters, two phase shifters, and two splitters on a single chip made of electro-optical material would have been obvious to one of ordinary skill in the art, as it is well known in the art and also since conserving space would always be beneficial. Moreover, it has been held that forming in one piece an article that has formerly been formed in two pieces and put together involves only routine skill in the art (*Howard v. Detroit Stove Works*, 150 U.S. 164 (1893)).

*Pertaining to claims 34-36*, Yao discloses the device as described above, but does not disclose the incorporation of a third input splitter, third and fourth combiners, and an additional phase shifter (polarization converter). However, it would have been obvious to one of ordinary skill in the art to include a third input splitter, third and fourth combiners, and an additional phase shifter (polarization converter), since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art (*St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8).

*Concerning claim 37*, Yao discloses the device as described above, but does not disclose the third splitter and the third combiner being formed as part of the chip. However, placing the third splitter and third combiner on the single chip made of electro-

optical material would have been obvious to one of ordinary skill in the art, as it is well known in the art and also since conserving space would always be beneficial.

*With regard to claims 40 and 41*, Yao disclose the device as described above, but does specifically state the splitter and combiner to be 3 dB devices. However, splitters and combiners that are 3 dB devices are well known and generally conventional and one having ordinary skill in the art would have found it obvious to use such a conventional splitter or combiner.

*Addressing claims 42-45*, Yao disclose the device as described above, and additionally discloses the splitter **12** and combiner **12'** are both Y-junction and waveguide couplers (Fig 3). The splitter is also shown to be at the input of the system and the combiner at the output of the system (Fig 3). Moreover, the first and second Mach-Zehnder modulators **22** and **24** have bias electrodes coupled to them (Fig 3, 5:63-67, 6:1-18).

*Concerning claims 46 and 47*, Yao disclose the device as described above, but does specifically state the splitter and combiner to be adjustable. However, one of ordinary skill in the art would have found it obvious to make the splitter and combiner adjustable, since it is well known in the art to do so for example to reduce distortion of the signal.

*With regard to claim 48*, Yao disclose the device as described above, and furthermore describes splitter **12** as a polarization splitter (5:63-67, 6:1-18, Fig 3).

*Pertaining to claims 49, 50, 52, 54, 58, 59, 62, 63, 68, and 69*, Yao describes a method of producing an optical output comprising (5:63-67, 6:1-18):

- Providing an optical device with first and second Mach-Zehnder modulators
- Producing a first output from the first Mach-Zehnder modulator.
- Producing a second output from the second Mach-Zehnder modulator.
- Combining the first and second outputs to produce a combined output.
- Applying a bias voltage to each of the first and second modulators to set a DC bias point.
- Detecting an average optical power of the combined output, as well as the average optical power of each the first and second outputs (5:30-37, Fig 2).
- Obtaining a 90-degree phase difference between the first and second modulators (6:1-18).
- Detecting optical variation of the combined output (5:30-62, Fig 2).
- Maintaining the same optical power at each channel of the first and second modulators, thereby ensuring the output power of each channel is equalized, by using a Y-splitter that evenly splits optical power to each of the two modulators (Fig 3).
- Driving each of the two modulators by an RF signal (5:63-67, 6:1-18, Fig 3).

However, Yao does not disclose the first and second modulators formed as part of a single planar chip made of electro-optical material. However, it would have been obvious to one of ordinary skill in the art to do so, as it is well known in the art and also

since conserving space would always be beneficial. Moreover, it has been held that forming in one piece an article that has formerly been formed in two pieces and put together involves only routine skill in the art (*Howard v. Detroit Stove Works*, 150 U.S. 164 (1893)).

*Pertaining to claim 69*, Yao discloses the method as described above, yet does disclose providing a device which has third and fourth Mach-Zehnder modulators being formed of a single chip formed of electro-optical material, producing an optical output from the third and fourth modulators, and combining this output with a second combined output signal gained from a similar device. However, it would have been obvious to one of ordinary skill in the art to include a third and fourth Mach-Zehnder modulator and combine their outputs with an optical output gained from a similar device, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art (*St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8). In addition, placing the four modulators on a single chip made of electro-optical material would have been obvious to one of ordinary skill in the art, as it is well known in the art and also since conserving space would always be beneficial. Moreover, it has been held that forming in one piece an article that has formerly been formed in two pieces and put together involves only routine skill in the art (*Howard v. Detroit Stove Works*, 150 U.S. 164 (1893)).

*Claims 51 and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yao (US 5654818) in further view of Betts (US 5867295).*

*Pertaining to claim 51*, Yao discloses the method as described above, but does not disclose maintaining the first and second modulators at extinction points. Betts discloses an optical system where parallel Mach-Zehnder modulators are maintained at extinction points (2:10-21). It would have been obvious to one of ordinary skill in the art to maintain the first and second modulators at extinction points, as Beets discloses doing so produces a pair of linearized modulators that avoid the optical power splitting/combining difficulties of standard parallel Mach-Zehnder architectures (Betts 2:10-21).

*Concerning claim 60*, Yao, in view of Betts, discloses the method as described above. Betts discloses an optical system where parallel arms of a Mach-Zehnder modulator are maintained such that their optical power variation between each arm is minimized (2:10-21). It would have been obvious to one of ordinary skill in the art to minimize the optical power of either the combined output or each individual modulator, as Beets discloses doing so produces a linearized modulators that avoid the optical power splitting/combining difficulties of standard parallel Mach-Zehnder architectures (Betts 2:10-21).

*Claims 53 and 55-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yao (US 5654818) in further view of Helkey et al (US 6469649).*

*Concerning claims 53 and 55*, Yao discloses the method as described above. However, Yao does not disclose minimizing the average optical power of either the

combined output or each modulator's individual output. Helkey et al discloses an optical system where the average output power of a single Mach-Zehnder modulator is minimized (9:33-50). It would have been obvious to one of ordinary skill in the art to minimize either the combined optical output, or each modulator's individual output, as this reduces the effect of noise from the optical source (Helkey et al. 9:33-50).

*Pertaining to claim 56 and 57*, Yao, in view of Helkey et al, disclose the method as described above. However, neither Yao nor Helkey et al disclose applying a signal to each of the first and second Mach-Zehnder modulators in response to either the average power of the combined output or the individual outputs. However, in view of the teachings of Helkey et al, it would have been obvious to one of ordinary skill in the art to apply a signal to each of the first and second Mach-Zehnder modulators in response to either the average power of the combined output or the individual outputs, as this ensures the minimization of the optical outputs, either individually or in combination, which thereby reduces the effect of noise from the optical source (Helkey et al 9:33-50).

#### ***Allowable Subject Matter***

Claims 38, 39, 61, and 64-67 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The applicable prior art does not disclose, nor does it reasonably suggest the following:

- An optical module as called for in the combination of claims 32 and 34-37, and further having the third splitter and third combiner formed as a part of a second, and separate chip, as is recited in claim 38.
- An optical module as called for in claim 32, where the modulators, first and second splitters, and first and second combiners are formed as a part of one chip, and the third splitter and third combiner are formed as part of a second chip, as is recited in claim 39.
- A method of producing an optical output as called for in claim 49, and further producing a signal in respond to a data-induced optical power variation of the combined output, as is recited in claim 61.
- A method of producing an optical output as called for in the combination of claims 49, 63, and 64, and further amplitude modulating at least one of the channels and detecting a power at the modulated frequency, as is recited in claim 64.
- A method of producing an optical output as called for in claim 49, and further obtaining a timing alignment between applied data signals and optical pulses, as is recited in claim 65.
- A method of producing an optical output as called for in claim 49, and further detecting an average output power from wither of the first or second modulators and producing a signal proportional to this average power related to a timing alignment between applied data signals or an optical pulse and an applied data signal, as is recited in claim 66.

- A method of producing an optical output as called for in claim 49, and further including a feedback control loop that produces a signal to maximize a voltage timing signal, as is recited in claim 67.

***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Delavaux (US 5060312) discloses a polarization independent coherent lightwave detection arrangement. Kondo et al (US 2001/0007601) discloses traveling wave optical modulators.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rhonda S. Peace whose telephone number is (571) 272-8580. The examiner can normally be reached on M-F (8-5).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney Bovernick can be reached on (571) 272- 2344. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

*Rhonda S. Peace*  
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Examiner  
Art Unit 2874

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9/5/04